# CHAPTER 1

# BACKGROUND AND RATIONALE

A knee joint is the largest articulation in the body. It is a modified hinge with an extensive range of motion. The stability of the joint is provided by the soft tissue structures: the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL), the medial collateral ligament (MCL) and the lateral collateral ligament (LCL), the menisci, the capsule, and the muscles. The ACL and PCL add stability to the joint and aid in proprioception. The subcutaneous location in a weight-bearing extremity combined with the relatively long lever arms exerting forces on the joint render the knee susceptible to injury. All of the structures that comprise the knee joint synchronously function through a normal, physiologic range of motion. Knee symptoms occur when any of these structures are altered, potentially creating interference with normal knee function.

The ACL and PCL limit the anterior and posterior displacement of the tibia on the femur, respectively. Since the intact ACL prevents anterior motion of the tibia on the femur, an ACL injury leads to abnormal forward movement of the tibial plateau. This abnormal motion leads to relative internal rotation of the tibia during the terminal part of extension. Absence of a functioning ACL and the related anterolateral rotatory instability can result in the sensation that the knee is buckling or "giving out." These symptoms occur with normal walking, but may be most prominent during pivoting movements, such as those that occur with quick changes in direction. In the absence of knee buckling, patients with ACL disruption may express a loss of confidence in the stability of their knee, possibly because of the ACL's role in proprioception.

A knee is one of the most frequently injured joints. Among those who sustained an acute traumatic hemarthrosis to the knee, the ACL was torn in more than 70% of patients (1, 2). The ACL is often injured during traumatic twisting injuries in which the tibia moves forward with respect to the femur, often accompanied by valgus stress. No direct blow to the knee or leg is required, but the foot is usually planted and the patient may remember a "popping" sensation at the time of the injury. The ACL is the primary

restraint to anterior displacement of the tibia and a secondary stabilizer for varus/valgus and rotational movement (3). Patients with torn ACL have problems with anterior knee instability. The natural history of an untreated complete torn ACL has been suggested to be the progression of symptomatic instability leading to recurrent injury, damage to the menisci and the articular cartilage, and secondary osteoarthrosis (4, 5). For these reasons, appropriate and timely diagnosis and management of an ACL injury is of utmost importance.

Attempts have been made to improve diagnostic accuracy other than clinical examination by the use of arthrometric measurements and magnetic resonance imaging (MRI) (6-8). There are many studies of the diagnostic accuracy of these tests with variable support for each(9-12).

However, clinical examination remains a key factor in diagnosing knee ligament injuries. The Lachman test (Figure 1) is one of the physical examination procedures to detect a torn ACL (13). The test basically consists of two components: 1. a translation of the tibia anteriorly in relation to the femur, and 2. a sense of an endpoint. Generally, the examiner stabilizes the femur with one hand and moves the tibia anteriorly in relation to the femur with another. The examiner perceives the degree of anterior tibial translation and the sense of end point. A knee with a torn ACL demonstrates increased anterior tibial translation and soft end point. The Lachman test is clearly the best examination to evaluate ACL integrity (1). Clinical examination performed by skill examiners is the most powerful diagnostic test as compared to MRI and arthrometry (14, 15). If a physician has obtained a history suggestive of ACL insufficiency and the physical examination is compatible with this impression, additional diagnostic studies are not routinely needed. However MRI scan is usually recommended for further investigation on a patient with an inconclusive examination.

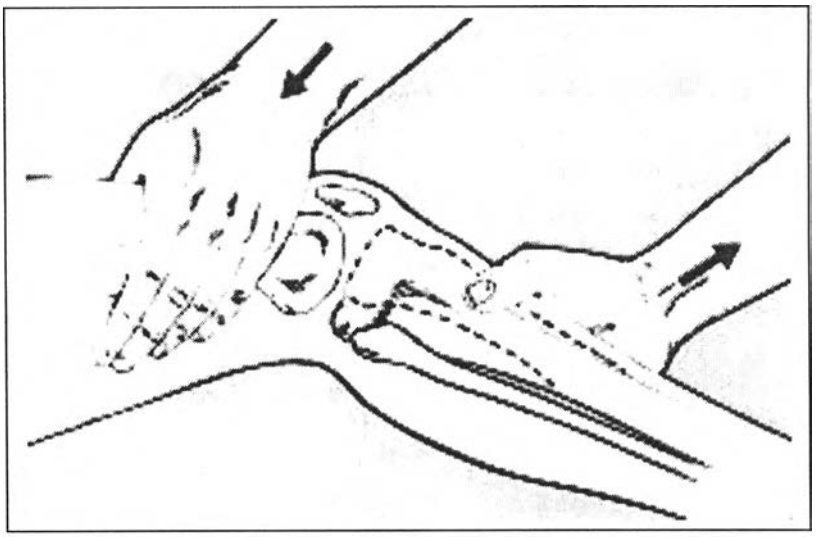


**Figure 1** The Lachman test

Nevertheless, accuracy of clinical diagnosis depends on the clinician's experience and expertise in evaluation. Execute the Lachman test and interpret the findings by clinicians sometimes are equivocal. The Lachman test requires keen sensitivity on the examiner's part. Subjective interpretation may lead to differences in reporting the results.

A modified technique of stress radiography to evaluate a torn ACL is introduced in this study. The purpose of this modification is to help unskilled examiner to document anterior translation of tibia on radiograph and make decision about ACL condition. This technique is so simple that it is feasible to perform in every hospital. This simplified stress radiography of the knee, as supplementary to clinical evaluation, may be an alternative of investigations to improve accuracy of diagnosis of torn ACL by an unskilled examiner and decrease a need for expensive MRI investigation of knees.

***Technique of a simplified stress radiography in diagnosis of a torn ACL (Figure 2)***

1. A patient is positioned laterally on the same side as the knee being examined.
2. The examined knee is flexed 20 $\pm$5 degree measured by a goniometer.
3. The lateral aspect of the knee is laid flat on the cassette. A small cushion supporting at ankle may be required to gain the position.
4. A first sling made from clothes is wrapped around a thigh just proximal to patella for thigh stabilization and tied posteriorly to a fixed object. A second sling is wrapped just

above the ankle joint and tied posteriorly to another fixed object. A last sling is positioned at the same level as a tibial tubercle and hanging with 20 lbs weight

5. An x-rays technician verifies the true lateral position by palpation the femoral epicondyles simultaneously and adjusts position until he feels that the medial epicondyle is directly on top of the lateral one and perpendicular to a cassette.

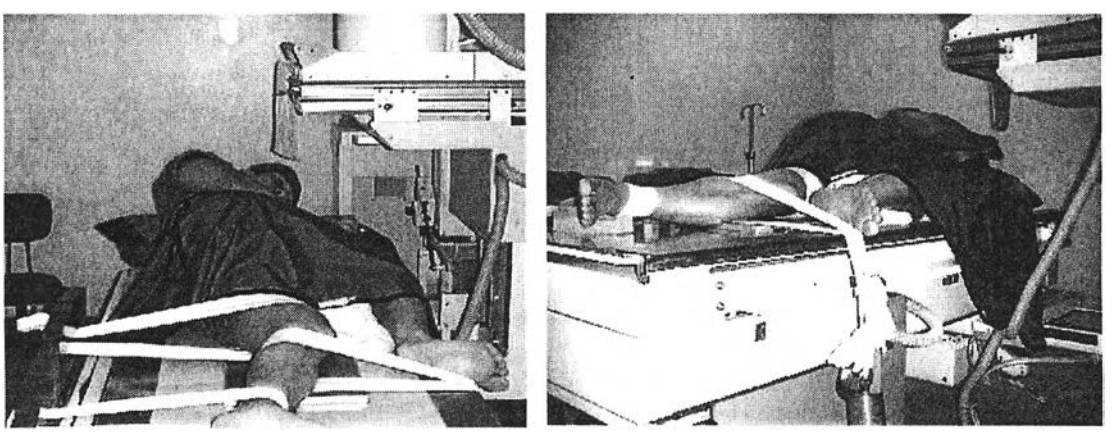
6. A medial joint line is the focal point of the x-rays tube.

7. A film focal spot distance is 1 meter. A radiographic machine is set at 57 Kv, 64mAs/s.

8. The patient is instructed to relax the leg muscles.

9. The weight is left in position then the radiograph is shot.

10. The contralateral knee is subjected to the same procedure for comparison.



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